

**Statewide *E. coli* Monitoring Project**

**July 1999-June 2001**

**Final Report**

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By

Roseann A. Hirschinger, Environmental Scientist

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Of the Surveys Section

Arthur C. Garceau, Surveys Section Chief

Indiana Department of Environmental Management  
Office of Water Quality  
Assessment Branch  
Surveys Section  
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## Abstract

A customized cargo van was equipped to create a mobile laboratory to test surface water samples for *Escherichia coli* concentrations using Standard Method 9223 Enzyme Substrate Coliform Test (Colilert®). The test method was approved by the IDEM commissioner for the assessment of recreational water in January 2000. The mobile laboratory was proposed as a solution to difficulties in collecting and delivering surface water samples to a laboratory within the six-hour holding time allowed. The surveys being conducted required that five-weekly samples be collected within a 30-day period to calculate a geometric mean of the *E. coli* concentrations.

This report furnishes information about the equipment and costs of the project. The documents developed to operate the laboratory in the best manner possible, work plans for the watershed assessment surveys and a report of the 2000 Basin surveys conducted with the *E. coli* Mobile Laboratory are attached. Data for all water samples, duplicate samples, and quality control samples tested in the *E. coli* Mobile Laboratory from June 2000 until October 2001 is presented in print and is available in electronic format.

The Surveys Section used the *E. coli* Mobile Laboratory in the Great Lakes Basins of Indiana during the summer of 2000 for work on Watershed Assessment, Source Identification, and Special Projects involving *E. coli* measurements. During the summer of 2001, the Surveys Section used the *E. coli* Mobile Laboratory for all *E. coli* testing required by Watershed Assessment, Source Identification, and Special Projects in the West Fork White River Basin and the Patoka River Basin. The TMDL work group in the Toxicology and Chemistry Section also used the Mobile Laboratory to process water samples from several five-week surveys.



## TABLE OF CONTENTS

Acknowledgements.....	viivii
Acronyms and Abbreviations.....	viiiiviii
Introduction.....	11
Timeline.....	2
Materials and Methods.....	44
Budget for the Project.....	77
Product.....	99
Achievements.....	1010
Challenges .....	1111
References .....	112

## LIST OF TABLES

Table 1 Equipment Installed in E coli Mobile Laboratory.....	66
Table 2 Grant Funds used for the Assembly of the <i>E. coli</i> Mobile Laboratory.....	77
Table 3 Matching contributions from the State of Indiana, estimated costs. ....	88
Table 4 <i>E. coli</i> Mobile Laboratory Work Load.....	1010

## LIST OF APPENDICES

Appendix A	Test Results from the Statewide <i>E. coli</i> Monitoring Project
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## LIST OF ATTACHMENTS

Attachment A	Work Plan for the <i>E. coli</i> Monitoring Project in the Great Lake Tributaries
Attachment B	Work Plan for the <i>E. coli</i> Monitoring Project in the West Fork White River Watershed and the Patoka River Watershed
Attachment C	The Guidelines for the Operation of the <i>E. coli</i> Mobile Laboratory
Attachment D	Grant Application for Clean Water Act Section 319 Nonpoint Source Management Program-Statewide <i>E. coli</i> Monitoring Project
Attachment E	Concentrations of <i>Escherichia coli</i> in Surface Water of the Great Lakes Watersheds of Indiana June –October 2000. Report No IDEM 032/02/046/2002



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The author would like to thank Dianne Zamani, Senior Microbiologist, Indiana State Department of Health, and her staff for the advise and training in the use of IDEXX testing materials and quality control procedures to assure the best possible operation of a mobile laboratory. The extra efforts working on the method comparison studies made the use of the new test method a practical solution to the holding time problem.

The author would also like to thank Cheryl Silcox, Hydrology Technician, of the Indiana District, United States Geological Survey for her advice on the planning and operation of a mobile laboratory. During 1998, 1999, and 2000, her work on *E. coli* concentrations in Indiana set a high standard and will stand as an example of the necessity for creative solutions to new requirements in the field of water quality assessment.

The author would like to express her appreciation for all the hard work and long hours by Brian Walden, a Summer Intern from June to August 2000, who was completing his degree from the School of Public and Environmental Affairs, IUPUI. The almost flawless execution of the inaugural *E. coli* survey can be credited to his assistance during the practical development of protocol for data entry, sampling, and testing.

The author would also like to thank Chris Alexander of Wabash College for his hard work in the field and his assistance in completing the 2001 surveys and *E. coli* testing. His help in the development of the data entry forms and the training of several permanent staff in the use of the form helped the project shorten the time between the sampling event and the release of the final data for departmental and public use.

## ACRONYMS AND ABBREVIATIONS

AIMS	Assessment Information Management System
App.	Appendix
°C	Degrees Centigrade
CFU	Colony forming unit
Fig.	Figure
Geo-Mean	Geometric Mean = $n^{\text{th}}$ root of the product of n results
GLI	Great Lakes Initiative
IDEM	Indiana Department of Environmental Management
IDNR	Indiana Department of Natural Resources
L	Liter
mL	Milliliter
MPN	most probable number
NTU	Nephelometric Turbidity Units
OWQ	Office of Water Quality
QA/QC	Quality assurance / quality control
QAPP	Quality assurance project plan
RPD	Relative percent difference –the absolute difference in the results between a sample and its duplicate divided by the average of the two results then multiplied by 100
Tbl.	Table
TNTC	Too numerous to Count
USEPA	United States Environmental Protection Agency
UV	ultra-violet light



## INTRODUCTION

The purpose of this report is to account for the use of funds granted by the USEPA 319 program for the purpose of establishing a mobile laboratory in a converted cargo van for the testing of *Escherichia coli* (*E. coli*) in surface waters of the State of Indiana. Reporting only on time, materials, and methods used would result in very limited accounting of resources used on the project. Instead, this report will attempt to describe the project in enough detail that the report could be used by technical personnel to initiate a similar program for assessing waterbodies for recreational use. The budgets, methods, and data described evaluate the feasibility of using this approach to solve holding time problems, and are not an endorsement of any one product or method.

The goals of this project were to (1) assemble the mobile laboratory, (2) develop procedures and a Quality Assurance Project Plan (QAPP) within the Assessment Branch's QAPP requirements (Bowren & GhiasUddin 1999), (3) conduct surface water sampling and testing which would meet the standards required for Data Quality Level 3 or 4, and (4) report on those surveys for the benefit of the various users of Assessment Branch water quality data.

The Statewide *E. coli* Monitoring Project was proposed to facilitate the testing of surface water to determine *E. coli* concentrations following the five-year basin rotation of the Surface Water Quality Monitoring Strategy (IDEM 1998b). This grant provided funding for the specialized equipment needed to assemble a mobile laboratory. The assembly of this mobile laboratory using the IDEXX Colilert® methodology was an innovative experiment for IDEM in the practicality of operating a water-testing laboratory within the constraints inherent with the use of a motorized vehicle. The results of this experiment indicate that the concept is practical, efficient, and economical.

A review of the water quality monitoring requirements that this grant addresses will assist the reader in the recognition of the importance and timeliness of this project.

The Surveys Section of the Assessment Branch of the Office of Water Quality, Indiana Department of Environmental Management (SS/AB/OWQ/IDEM) is charged with the collecting of surface water quality data for the assessment of the waters of the State. This information is used to report on the condition of the waters of the State as required by Section 305(b) of the Clean Water Act. In addition to the 305(b) report, assessments are made to determine the extent and source of impairments prior to listing stream reaches on the 303(d) list of Impaired Waterbodies. As Total Maximum Daily Load projects are initiated, detailed data of all parts of the impaired waterbody is needed to calculate the various impacts all sources of pollution have on the stream reach. Local governments and citizen groups need access to water quality data for planning and improvement of surface water use in areas of local interest. Emergencies involving acute water pollution must be investigated occasionally. N.P.D.E.S. permits are based on existing water quality data along with consideration of the need to enforce non-degradation and water quality improvement decisions. The clients of the Assessment Branch, Surveys Section are the organizations and individuals working to fulfill these water quality obligations.

The State of Indiana has only one recreational use category for all waters of the State, that is, the highest, full body contact recreational water. Indiana's water quality standard for recreational waters is set forth in 327 I.A.C. 2-1-6 and 2-1.5-8(e)(2) (IDEM 1998):

“*E. coli* bacteria, using membrane filter (MF) shall not exceed one hundred twenty five (125) per one hundred (100) milliliters as a geometric mean based on no less than five (5) samples equally spaced over a thirty (30) day period nor exceed two hundred thirty five (235) per one hundred (100) milliliters in any one (1) sample in a thirty (30) day period.”

Due to the variation of *E. coli* concentrations in any particular stream reach at any particular time, a geometric mean gives a more accurate representation of bacteriological water quality of a waterbody. Historically, bacteriological data collected by the Surveys Section has shown *E. coli* to be prevalent throughout Indiana in non-point source influenced waters. Prior to the Statewide *E. coli* Monitoring Project, watershed assessment surveys usually collected a single sample per sampling site for bacteriological testing in order to facilitate a water quality assessment. With the improvement of quality assurance/quality control and more stringent adherence to requirements of the Indiana Stream Standards, the *E. coli* bacteria parameter presented a challenge for the Watershed Monitoring Work Group in Surveys Section to collect and deliver samples for *E. coli* testing. The requirements of analytical test methods, SM 9213 D. and SM 9223 B. (APHA 1998), suggest the following holding time for *E. coli* sampling:

“Hold source water, stream pollution, recreational water, and wastewater samples below 10°C during a maximum transport time of 6 hours. Refrigerate these samples upon receipt in the laboratory and process within 2 hours. When transport conditions necessitate delays in delivery of samples longer than 6 hours, consider using either field laboratory facilities located at the site of collection or delayed incubation procedures” (sec. 9060 B., Page 9-21).

Collecting samples in the field and delivering them to a contract laboratory within a six-hour time period greatly restricted both the location and the number of sites that could be evaluated. Contracting with the USGS in a Federal-State Cooperative Water Program, which provided both sampling and membrane filtration testing services in a field laboratory, was becoming too expensive.

Thus, the need to collect bacteriological data in a timely and acceptable manner was seen as imperative for assessing recreational use attainment and modeling pollutant sources in impaired waters for TMDL studies.

## TIMELINE

The Indiana State fiscal year of July 1, 1999 to June 30, 2000 marked the first year of the Statewide *E. coli* Monitoring Project. Surveys Section staff had hoped to obtain and assemble the *E. coli* Mobile Laboratory in time to use it at the end of the 1999 recreational season. Staff was hired in February of 1999 to initiate the requisition and planning process. All material and methods decisions had to be researched and documented to enable submission of requisitions to the purchasing department at the beginning of the fiscal year. The most challenging aspect of the planning process was to specify criteria for the van conversion, obtain estimated costs, and to find conversion shops willing to do the work. Purchasing the necessary equipment required over six months to complete.

During the winter of 1999-2000, Staff wrote a work plan and standard operating procedures to guide personnel in the operations of the *E. coli* Mobile Laboratory. Research included training at the Indiana State Department of Health (ISDH) Microbiology Laboratory and the LaPorte County Health Department Laboratory. Both of these laboratories had used the IDEXX Colilert®

methods for drinking water and surface water testing. The following documents were consulted to develop protocol for the *E. coli* Mobile Laboratory including:

- 1) Method 9223 in the Standard Methods for the Examination of Water and Wastewater, 20<sup>th</sup> Ed. (APHA 1998)
- 2) Standard Operating Procedure #1103 from USEPA Region 9 Laboratory, Richmond California
- 3) Manual for the Certification of Laboratories Analyzing Drinking Water EPA 815-B-97-001
- 4) Standard Operating Procedure for Recreational Water Collection and Analysis of *E. coli* on Streams, Rivers, Lakes and Wastewater, Revised 3-99, which was developed by the Interagency Task Force on *E. coli*.
- 5) Product instructions from IDEXX Laboratories Inc.

The 2000 (Attachment A), 2001 (Attachment B) work plans, as well as *Guidelines for the Operation of the E. coli Mobile Laboratory* (Attachment C) are included with this report.

The long body cargo van was delivered March 23, 2000 and immediately taken to the shop for the interior conversion. The conversion was completed on May 6, 2000. The van was equipped and driven on a pre-survey to assure that the equipment was secure and the van was operable. Between May 25 and October 26, 2000, the *E. coli* Mobile Laboratory was driven 11,200 miles. Three five-week surveys to evaluate 92 sites were conducted during the 2000 sampling season in the Great Lakes Tributary Basins plus two source I. D. surveys and a special project designed to follow up on a CSO study.

The development of the Assessment Branch Information Management System (AIMS) progressed on virtually the same time line as the Statewide *E. coli* Monitoring Project. The initial task of the AIMS Project for Fiscal 1999 was development of the data base structure and the migration of data from non-Y2K-compliant databases. Field data and lab data entry forms however, were developed for surveys that were planned for the 2000 field season. Development of the *E. coli* Mobile Laboratory's data management procedures in conjunction with the AIMS Project was one of the tasks emphasized during the period of March 2000 to June 2001.

The second year of surveying was conducted in the West Fork White River and Patoka River Basin between April 23 and October 10, 2001. The amount of work performed in the *E. coli* Mobile Laboratory greatly increased during the 2000 sampling season. The growth in the number of samples and surveys completed was accomplished by increasing the number of sampling crews in the field. The newly formed TMDL work group conducted numerous intensive surveys of impaired waterbodies and delivered samples to the *E. coli* Mobile Laboratory. Co-ordination of surveys and data sharing facilitated an extraordinary amount of spatial coverage and data collection in the watersheds. During the 2001 recreational season, the *E. coli* Mobile Laboratory was driven 9,165 miles. Four surveys to evaluate 106 sites were conducted using the van for sample collection and testing. Additional samples were processed in the lab for nine TMDL surveys, two Source I.D. surveys and one special investigation of a confined feeding operation.

The *E. coli* Mobile Laboratory will be used in the East Fork White River and Whitewater River Basins during the 2002 sampling season.

## MATERIALS AND METHODS

The vehicle obtained for the *E. coli* Mobile Laboratory was a 2000 Chevy Express long body van. The materials used in the conversion are listed below:

1. Viking camper top-24" raised roof
2. 2 each Creation 33x16 side slider windows with screen
3. Reflective insulation in roof and wall, covered
4. Washable Bath Board style paneling
5. Enclosed storage area, custom built over Driver/ passenger compartment to hold personal property and safety gear
6. Metal Bulkhead divider with door. This is a required safety feature in all survey vehicles
7. Weatherguard Cabinets
8. 36" cabinet top
9. 2 each 8313-3 cabinets Hinged, locking doors for sealer, media cooler, and pipettes
10. Wheel well cabinet 8141-3
11. Weatherguard shelving 69" 3 high lipped shelves
12. Weatherguard shelving 36" shelf constructed for the incubators
13. 12-volt power roof vent
14. 12-volt fluorescent lights
15. Interstate marine battery with cables and mounts
16. 300-Amp power inverter
17. Continuous duty solenoid
18. 4 each double outlets
19. Exterior 110-volt connect to supply power from extension cord
20. Ground fault interrupter
21. Volt meter to monitor battery charge
22. Audio Alarm for power failure
23. Strobe lights front and rear required for roadside work safety
24. Removable rubber floor mat for work area

See photographs on the following page for general layout of the *E. coli* Mobile Laboratory.



Surveys Section *E. coli* Mobile Laboratory  
"Buggy"



Bench Space, Cabinets, and Sealer



Side door entry, note small incubators. The lowest shelves on the left were fitted for coolers and supply boxes



Main Work Space, Plenty of Shelves



Overhead Storage and Bulkhead

The equipment obtained for this project included extra units for redundancy due to the factors associated with the equipment being in a moving vehicle for most of the season. The equipment was very reliable and the extra equipment was loaned to the IDEM Northwest Regional office in Gary for the use by the Non-point Source Committee of the Task Force on *E. coli*. This was practical because the Gary office was in the same area that the *E. coli* Mobile Laboratory was operating. It was agreed that if there were a failure of equipment in the *E. coli* Mobile Laboratory, the units in Gary would be used for replacement. The Gary office would ship and receive the units as covered in the warranties.

All of the capital laboratory equipment was obtained from the IDEXX Corporation. IDEXX has been supplying this type of equipment to small drinking water laboratories for many years and were able to provide the appropriate equipment for space limited quarters. The laboratory equipment is listed in Table 1.

**Table 1 Equipment Installed in E coli Mobile Laboratory**

Number	Item	Cost
2	WQTS2X--115 v Quanti-tray sealers w/ 3 year maintenance agreement	\$3400.00 each
3	WQTSRBR-2K--rubber inserts for the Quanti-tray 2000	\$ 40.00 each
2	WL 160 - 6-watt 360 nm UV light	\$ 89.00 each
2	WL 161 - 6-watt replacement bulb	\$ 18.00 each
2	WP102-QT P/A color comparitor	\$ 6.00 each
3	W1300 120 V 30-65c Incubator	\$389.00 each
	VRW Low- Temp/BOD incubator, Model 200*	\$1090.00 each

\* VRW incubators replaced W1300 models in second year of Grant

The testing supplies are priced according to the volume purchased each year. The Indiana State Department of Health operates a drinking water laboratory and purchases in excess of 40,000 units of Colilert<sup>®</sup> Enzyme Substrate per year. The supplies needed by the *E. coli* Mobile Laboratory were purchased on their price schedule at \$5.50 per test. Each test requires one Quanti-tray 2000<sup>®</sup>, one sample bottle, and one packet of Colilert<sup>®</sup> P/A enzyme substrate (media).

The tests generate live cultures of *E. coli* bacteria that are potentially pathogenic and must be considered a biological hazard for proper disposal. A medical waste disposal company was contracted to supply and pick-up 4.5 cubic foot biohazard boxes for incineration. They also supplied a 2.5 cubic foot box, which was used in the *E. coli* Mobile Laboratory. The original contract for 25 pick-ups lasted most of the two years, but was exhausted late in the 2001 sampling season because of the extra work which was done for the TMDL projects.

Additional items needed to complete the laboratory supplies are listed below:

- |    |  |                  |
|----|--|------------------|
| 1) | 10 mL wide tip pre-sterilized disposable pipettes, 200 per case Falcon Item 7504                                     | \$79.10 each     |
| 2) | Bench Disinfectant/detergent, 6- ½ gal bottles per case, Conflict Brand  | \$84.95 per case |
| 3) | Minimum Maximum Thermometers   | \$45.75 each     |
| 4) | Paper towels, vacuum to clean the floors, vehicle safety equipment all supplied as part of the Surveys Section Fleet | N/A              |

One major change in the *E. coli* Mobile Laboratory equipment was made during the second year of the Project. The small gravity-convection incubators supplied by IDEXX were found to be problematic in the mobile setting because the thermostat was controlled by ambient temperatures, which varied a great deal in the van. A BOD style incubator, which can cool as well as heat, was installed, and the Power Inverter and Batteries were upgraded by the State Motor Pool to supply adequate power through the night. The new incubator worked quite well, but needed to be calibrated frequently. The small incubators continued to be used as back-up equipment during unforeseen vehicle maintenance, in the Surveys Section Workroom, and as equipment loaned to the Northwest Regional Office and the TMDL work group. The strobe lights were replaced by the State Motor Pool early in the spring of 2001 with a set that did not protrude from the roof.

## BUDGET FOR THE PROJECT

The project manager was responsible for requisitioning the necessary equipment to assemble the *E. coli* Mobile Laboratory while keeping the proposed plans within the budget of the grant. The Operations Branch of OWQ and the Purchasing Section of the IDEM Office of Management, Budget, and Administration (OMBA) were responsible for the actual purchase of the items required. Allocations of grant monies are listed in Table 2. Detailed information on purchases would have to be obtained through the IDEM purchasing department.

**Table 2 Grant Funds used for the Assembly of the *E. coli* Mobile Laboratory**

Date	Item	Cost	Funds	Balance
<b>Original Grant Amount</b>			\$44,479.00	
11/15/99	2000 Chevy Van	\$ 18,975.00		\$25,504.00
2/22/00	Conversion	\$ 9,049.00		\$16,455.00
1/12/00	Lab Equipment	\$ 8,728.00		\$ 7,727.00
4/28/00	Bio-hazard pickups	\$ 662.50		\$ 7,064.50
1/20/00	Supplies for 600 tests	\$ 2,460.00		\$ 4,604.50
2/09/00	Pipettes detergent	\$ 198.75		\$ 4,405.75
8/**/00	Supplies for 400 tests *	\$ 1,420.00		\$ 2,985.75
4/28/00	Wet /dry Vacuum	\$ 94.00		\$ 2,891.75
2/09/00	Collection Bottles 1000	\$ 448.75		\$ 2,443.00
2/20/01	Q-Trays 900	\$ 900.00		\$ 1,543.00
2/20/01	IDEXX media 400**	\$ 1,040.00		\$ 503.00
	Additional 319 funds obtained for new incubator		\$ 583.41	\$ 1,086.41
	<u>BOD incubator</u>	<u>\$ 1,086.41</u>		<u>\$ 0.00</u>
	<b>TOTAL</b>		<b>\$45,062.41</b>	

\* IDEXX double-shipped Media by mistake, so there was extra Media to start the year

\*\* TMDL group supplied about 400 sets of test supplies for the surveys they were conducting.

In Table 3, the costs to IDEM for this project are estimated from vehicle logs and travel vouchers. The figures are presented only to establish a basis for any proposed budgeting for other projects of this type. By estimating these expenses, total costs of operating a program of this nature can be appreciated. Detailed accounting of matching funds should be obtained from the OWQ Operations Branch.

**Table 3 Matching contributions from the State of Indiana, estimated costs.**

ITEM	COST
Salary and Benefits 1 Full time ES3 for 2 Years	\$ 86,000.00
Gas and Maintenance	\$ 3,200.00
Additional Equipment for Van, signs, strobes, inverter	\$ 3,000.00
Salary & Benefits for 41.5 days of Staff time @ ES3 rate\$165.00/day	\$ 6,850.00
Salary and Benefits for Interns, 16 weeks for two years	\$ 13,200.00
Lodging for two staff, 80 nights @\$65.00/night	\$ 5,200.00
Per Diem Expenses 125 days @ \$26.00/day	\$ 3,250.00
TOTAL IDEM FUNDS	\$120,000.00
TOTAL USEPA GRANT FUNDS	\$45,062.41
GRAND TOTAL	\$165,062.41

Using these figures, this project was able to assess 198 sites for approximately \$830.00 per site during the 2000 and 2001 field seasons. The EPA and IDEM funds invested in establishing this program will create long term savings.

The difference between the costs of the Mobile Laboratory surveys, conducted in 2000 and 2001, and the USGS co-operative water program surveys, conducted in 1998, 1999, and 2000, is the result in the change of testing methods. The USGS used the Membrane Filter Method, which required a large amount of disposable supplies, numerous pieces of equipment to prepare and analysis the samples and a considerable amount of time each day working with the samples in addition to the field work required to collect the samples. The personnel associated with the surveys had to have considerable experience to be able to control the environment in their mobile laboratory setting to maintain a safe working environment. In 2000, in the Ohio Tributaries of Indiana, USGS surveyed 40 sites in three 5-week surveys at the cost of \$130,070 to the State and an additional USGS match of at least \$100,500. This amounted to \$5,765 per site evaluated in the Ohio River tributaries. This co-operative program was innovative at its inception, but the requirements of the method proved to be too burdensome to be practical.

Changing the method used to perform *E. coli* testing for the assessment of recreational waters of the state was the first requirement for IDEM Assessment Branch to increase assessments and save money at the same time. With the Colilert® Quanti-tray method, the amount of supplies, equipment and laboratory time were greatly reduced. The amount of time staff could spend collecting samples was greatly increased. The Mobile Laboratory operations were concise and practical, while being simple enough that few problems were encountered in training personnel with no practical microbiological experience. With the capital investments made, IDEM can assess sites with a 5-sample geometric mean for about \$650.00 per site.



## PRODUCT

The *E. coli* Mobile Laboratory is fully functional and can be easily demonstrated to interested parties with a reasonable amount of notice. The 2000 and 2001 work plans were written and executed fulfilling the goal of obtaining geometric means for five samples within a month for a large number of sites over a large area of the State. *The Guidelines for the Operation of the E. coli Mobile Laboratory* document was developed and subsequently improved. It is included as Attachment C to this report.

The report *Concentrations of Escherichia coli in Surface Water of the Great Lakes Watersheds of Indiana June –October 2000*, Report No IDEM 032/02/06/2002, is included as Attachment E and thoroughly describes the methods, materials, and results of those surveys.

The Statewide *E. coli* Monitoring Project was the subject of a feature article in Indiana Materials Exchange in September 2000. Two public demonstrations were given that spring and summer. The *E. coli* Mobile Laboratory was in the Governor's Health Park at the Indiana State Fair for eight days. It was also demonstrated during the Indiana Water Resource Association Annual Conference at Spring Mill State Park. In the spring of 2001, the *E. coli* Mobile Laboratory was demonstrated for the Central Indiana Chapter of Environmental Health Association in Indianapolis.

The second cycle of the Assessment Branch 5-year rotation of watershed assessments began in 2001 (IDEM 2001). It is hoped that similar coverage can be achieved over the remaining four years of the cycle.

The report *Monitoring Escherichia coli Concentrations in Surface Water from the West Fork White River and Patoka River Basins in Indiana, April –October 2001* Report Number IDEM 032/02/053/2002 (in print), is being prepared and will be available on the Assessment Branch Web Page (<http://www.state.in.us/idem/owm/assessbr/assessindex.html>) when it is completed.

Table 4 describes the number of sites and tests performed in the *E. coli* Mobile Laboratory. A table of all the samples tested in the *E. coli* Mobile Laboratory is included with this report as Appendix A. The reports of the TMDL surveys that used the *E. coli* Mobile Laboratory will be available on the IDEM Assessment Branch Web Site.

**Table 4 *E. coli* Mobile Laboratory Work Load**

2000	3 Watershed Assessment Surveys	2 Source I.D Surveys	1 Special Project Survey	
Sites Assessed	92	35?	12?	
Surface Water Samples	462	54	?	
Dilution Samples	134	54	?	
Quality Control Samples	146	6	6	
Supplies	900 test kits			
2001	4 Watershed Assessment Surveys	2 Source I.D Surveys	1 Special Project Survey	7 TMDL Surveys
Sites Assessed	106	35	7	65
Surface Water Samples	527	70	14	324
Dilution Samples	30	70	14	60
Quality Control Samples	172	23	6	120
Supplies	~1000test kits			~500 test kits

## ACHIEVEMENTS

The Statewide *E. coli* Monitoring Project was highly successful in its first two years. The methods and quality control requirements were simple enough to maintain high standards while at the same time collecting and performing analyses on many samples per day.

The Assessment Branch Information Management System (AIMS) database was being developed during both years of the project. The issues addressed in regards to the operations of an in-house laboratory and the necessity of QA/QC reviews of data prior to creating the permanent records of the sampling events and test results were refined throughout the course of the Project. The *E. coli* Mobile Laboratory data management began with an Access database called “*E. coli*”. This preliminary process evolved through various stages to arrive at the current Electronic Data Interchange (EDI) by the end of the summer of 2001. The EDI data entry forms are used to enter test results from the laboratories for QA/QC officers to examine for accuracy, precision and completeness, flag the data where necessary, and then transfer it to a permanent record with a data quality assessment.

Staff from the Surveys Section and the Toxicology and Chemistry Section were trained the *E. coli* Mobile Laboratory for a week at a time. The following is a list of permanent staff trained for a minimum of three days in the *E. coli* Mobile Laboratory with the manager.

### Surveys Section.

1 Senior Environmental Manager 1  
1 Section Chief  
2 Environmental Scientist 3

### Toxicology and Chemistry Section

2 Chemist 2  
1 Environmental Manager 2  
1 Branch Chief

Two Summer Interns were assigned to work in the *E. coli* Mobile Laboratory from the middle of May until the end of August in 2000 and 2001. The advantage of having regular and well-trained assistants was greatly appreciated by the project manager. In 2001, two other interns went out for a week each and three other full time staff assisted for one day each.

The suggestion made in the grant proposal that interns could operate the *E. coli* Mobile Laboratory without permanent staff was abandoned. A permanent manager is necessary because of the many details that must followed to provide the continuity required for quality control.

## **CHALLENGES**

The *E. coli* Mobile Laboratory will continue to operate as an important tool for watershed monitoring and assessment. Now that routine operating procedures have been established and the first report has been written, the operation can proceed as a familiar part of the Assessment Branch Surveys Section program of surface water quality monitoring. In the next three recreational seasons, the Basins of the East Fork of the White River, the Whitewater River, the Upper and Lower Wabash River and the Kankakee River will be studied according to the rotating basin design of the Surface Water Monitoring Strategy (IDEM 2001). The Offices of Water Quality and Land Quality have recognized that these methods are an economical way to study *E. coli* concentrations for N.P.D.E.S. and Land application permit enforcement, source identification, and lake management issues. Staff will be prepared to perform special projects to support these programs. The project has been so successful that the TMDL work group has invested in a permanent in-house laboratory to use the IDEXX methods and also in another mobile laboratory to study impaired waterbodies. The standards of operation, quality assurance and quality control, and the use of the AIMS data base have been adopted by the group and the Statewide *E. coli* Monitoring Project manager will continue to provide training, advice and assistance to the TMDL work group as they proceed.

## REFERENCES

APHA 1998, American Water Works Association, and Water Environment Federation. 1998. *Standard Methods for the Examination of Water and Wastewater* 20<sup>th</sup> ed. Washington D.C., American Public Health Association.

Bowren T, GhiasUddin S. 1999. *Quality Assurance Project Plan (QAPP) for Indiana Surface Water Quality Monitoring Programs*. Revision 2, July 1999. Indiana Department of Environmental Management, Office of Water Management, Assessment Branch. Indianapolis, Indiana. Prepared for US Environmental Protection Agency (USEPA) Region V, Water Division. EPA Grant No M005180-99-0, C995008-99-0. IDEM 032/01/1442/1999. 103 p. 7 ap.

IDEM 1998. *Indiana Environmental Rules: Water*, 327 IAC 2-1-6. Indiana Department of Environmental Management, Indianapolis, Indiana. Document Number: 8126 1998.

IDEM 1998b. *Surface Water Quality Monitoring Strategy 1996 – 2000, Revised May 1998*. Indiana Department of Environmental Management, Office of Water Quality, Assessment Branch, Surveys Section, Indianapolis, Indiana. IDEM 032/01/013/1998.

IDEM 2001. *Surface Water Quality Monitoring Strategy 2001 – 2005*. Indiana Department of Environmental Management, Office of Water Quality, Assessment Branch, Surveys Section, Indianapolis, Indiana. IDEM 032/01/021/2001.